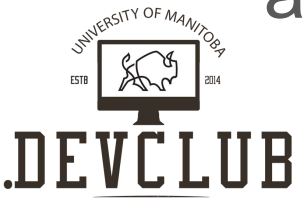
Introduction to Git Versioning with GitHub

Organized by University of Manitoba IEEE and .devClub



Word From UMIEEE Chair

Aislinn Livingston

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What is UMIEEE?

- Member-exclusive lounge
  - Study space for your courses (instead of a public library)
  - Make some awesome, kind friends
  - Get help for your homework (sort of)
- Member-exclusive lab (plus UMSAE)
  - School/personal projects (breadboards, Arduinos, etc.)
  - High-performance computer
- UMIEEE events
  - Workshops (professional development, technical skills, etc.)
  - AMAs (Ask Me Anything)
  - Industry tours

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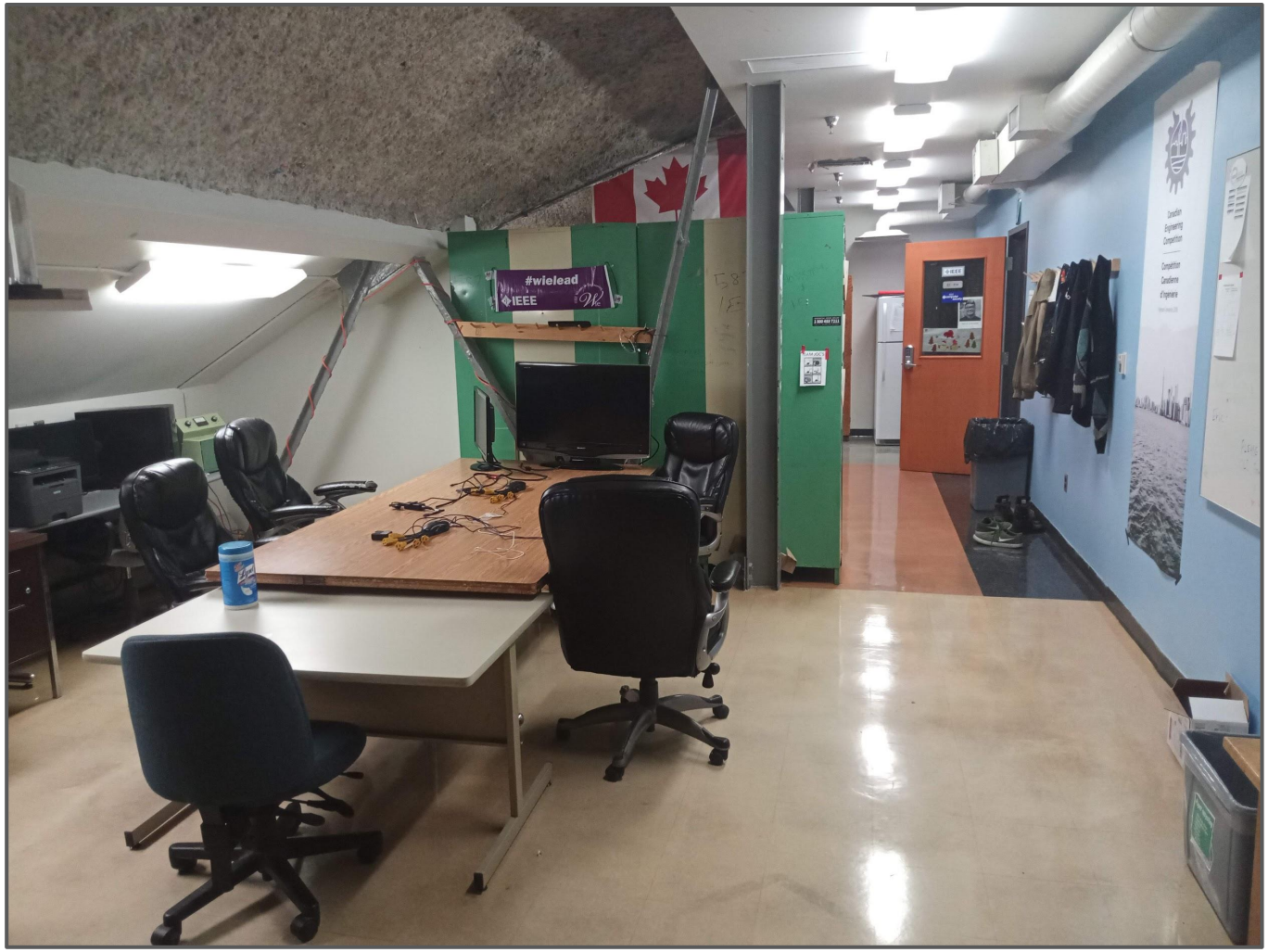

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Word From .devClub Executive

Mohsen Yousefian

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Your UMIEEE Workshop Presenters

Mohsen Yousefian

Mahyar Mirrashed

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Topics to be Covered (Agenda)

- Installing Git SCM on your personal machine
- Creating a GitHub account
- Git concepts (untracked files, staging area, and repositories)
- Git commands for creating projects
- Git commands for committing changes to projects
- Git commands for feature branching
- Git commands for feature merging

Approximated length: 50-60 minutes. Extra 10 minutes at end for questions.

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Workshop Layout

- Workshop (mostly) aimed at professional users
  - Professional users use Git for workplace scenarios (follow along with shell)
    - Please use PowerShell if on Windows (Start Menu → [Search “PowerShell”])
    - Please use bash if on MacOS/Linux

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Getting the Most From Online Workshops

- Take notes!
- Ask questions in Google Meet chat!
- Follow along if possible!

Take advantage of this UMIEEE workshop to the greatest extent possible!

Why Learn Git?

- Keep track of changes to multiple files
  - Allowing you to revert changes if necessary
- Simplifies working on files and projects with multiple people
  - Imagine working on PowerPoint presentation with multiple people using USBs

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Installing Git SCM

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Installing Git SCM

- For Windows: https://git-scm.com/download/win
  - If unsure regarding 32-bit and 64-bit distributions, head to Start Menu → About your PC → Device Specifications → System Type
- For Mac: https://git-scm.com/download/mac
  - May have to install Homebrew beforehand: https://brew.sh/
- For Linux: https://git-scm.com/download/linux

Head to shell and execute `git --version` to ensure proper functioning.

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Creating GitHub Account and Code Repository

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Creating GitHub Account

- Create GitHub account at https://github.com/join

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Understanding: Code Repositories

- Similar to project folders, but for code
  - Contains all project files on cloud
  - Stores each file's revision history
- Repository types
  - Private individual repositories (only with GitHub Pro)
  - Publicly shared repositories (like open source projects)
- Every repository belongs to user account or team
  - Repository owners have complete control (deletion, management, etc.)

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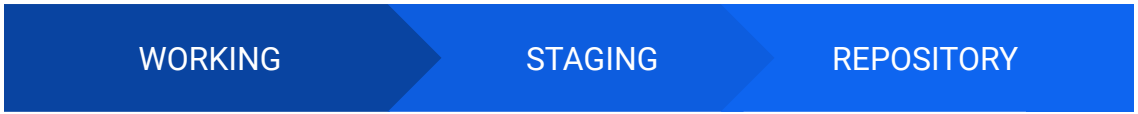
Understanding: Basic Git SCM Process

- Working area (untracked)
  - Modified files *not ready to commit* to repository
- Staging area (tracked)
  - Modified files *ready to commit* to repository
- Repository
  - Files *committed* to be stored on cloud



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Creating a Git Repository

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Creating your First Code Repository

- Head to GitHub main page at https://github.com/
  - Click on green “New” button → 

- Use following details during creation:
  - Repository name: Personal
  - Description: Personal repository for miscellaneous pieces of code.
  - Public/Private: [Select “Private”]
  - Add a README file: [Uncheck]
  - Add .gitignore: [Uncheck]
  - Choose a license: [Check]
    - For license type, select “MIT License”

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Copying “Cloning”, Adding Files, and Making Commits on Git Repository

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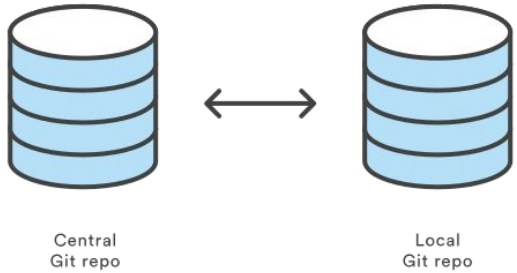
Understanding: Cloning

- Duplication is referred to as “cloning” in Git
  - **Origin/central** repository is like bank (single source of truth) on GitHub servers
  - Personal users duplicate/ “clone” from **origin** to obtain **local** version



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Cloning an Origin

- Retrieve the link to your repository
  - On GitHub.com tab, select your repository from list
  - Head to repository page and click on “Code” button → 

  - Copy the HTTPS link
- On shell, using `cd`, move into parent folder for repository directory
  - Navigate (`cd`) to non-OneDrive synced directory (if on Windows) and execute `mkdir GitHub`
    - Afterwards, navigate into newly created directory
  - Execute `git clone <repository>`
    - `<repository>` will be same HTTPS link mentioned above
  - In case of (fatal) error, execute `git config --global core.askpass`

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Creating Files in Local Repository

- Option 1: Use the graphical user interface
  - Right-click (on empty part of explorer) → New → Text Document
    - Name as “locations.txt”
  - Double-click file, type “Earth’s Moon”, and save document (CTRL + S)
- Option 2: Use the shell
  - Execute `echo “Earth’s Moon” >> locations.txt`
    - No response indicates successful file creation
    - Execute `echo “Earth’s Moon” >> locations.txt` on Linux or MacOS

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View Status of Local Repository (optional)

- On shell, execute `git status`
  - Shows that file is untracked (Git sees file not ever previously committed)

Untracked files are going to be red.

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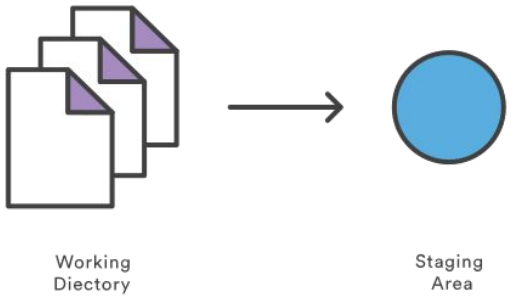
Adding Files to Local Repository

- On shell, instruct Git to track `locations.txt`
  - Execute `git add locations.txt`
    - No response indicates successful file creation
  - Command moves file from working directory to Git staging area
    - Used to prepare snapshot of set of changes prior to committing to history



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View Status of Local Repository (optional)

- On shell, execute `git status`
  - Shows added (staged) and tracked files
  - Changes are ready to be committed

Tracked files are going to be green.

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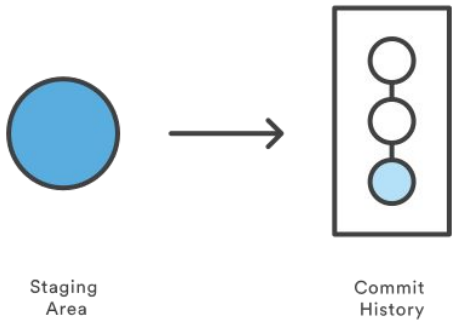
Committing Files to Local Repository

- On shell, execute `git commit -m “Initial commit”`
  - Takes staged “snapshot” and commits to project history
- Alongside `git add`, `git commit` defines basic workflow for most Git users



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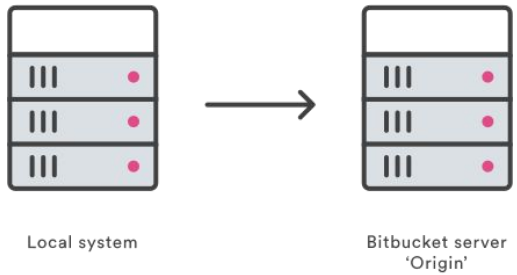
Pushing Files from Local to Origin Repository

- On shell, execute `git push`
  - Command specifies push to origin (central repository)

To check proper push, go to GitHub repository online, refresh page if needed, and view `locations.txt` as having been uploaded to origin.



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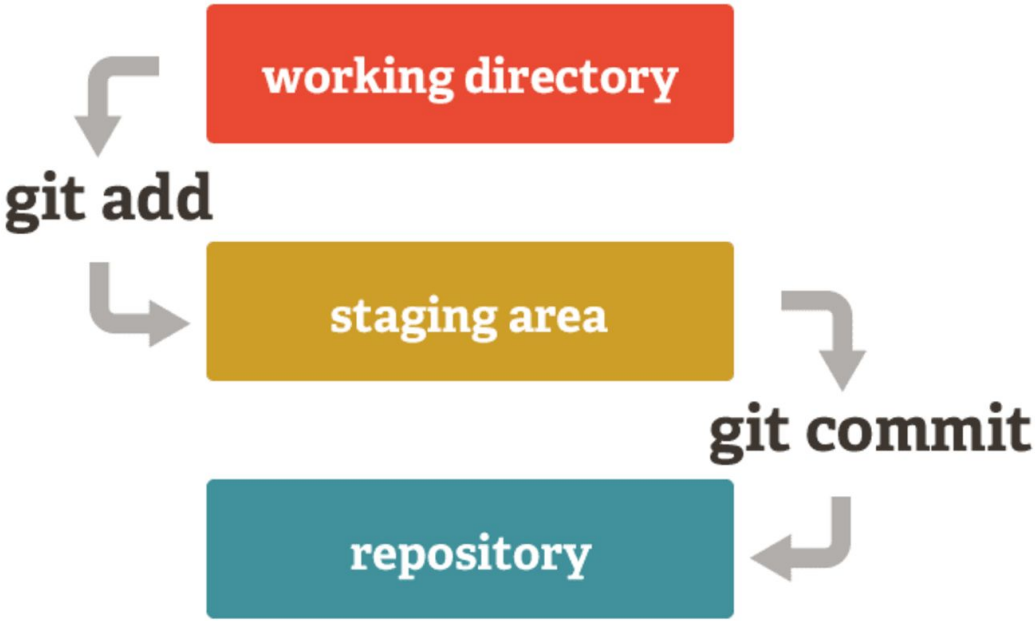
Workflow Diagram for Local Changes



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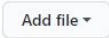
Creating Files on Origin Repository

- Head to created GitHub repository
- Click on white “Add file” button → 

  - Then, click “Create new file”
- For name field, enter “places.txt” in name field
  - Enter “Riding Mountain” in larger field potion
  - Scroll to bottom and click “Commit new file” → 

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Pulling Files from Origin to Local Repository

- On shell, navigate to top level of local repository
  - Execute `git pull --all` to pull all changes from origin
    - Enter GitHub password if prompted

Pulling merges files from origin repository to local repository.

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One last tip: Discarding local changes

- You can discard all of the changes you have made (revert working changes or not committed)
  - Execute `git check -- <filename(s)>` to discard your local working changes
  - Or `git check -- *` to discard all of the working changes

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Understanding: Git-based Collaboration Workflow

- Communication with remote repositories (like GitHub) is foundation of every Git-based collaboration workflow
  - Every developer has copy of repository
    - With personal local history
    - With personal branch structure
  - Users share series of commits rather than single changesets
  - Rather than committing changesets, Git allows sharing of branches between repositories
- Manage connections with repositories
  - Publish local commits to the origin by “pushing”
  - Updating local files based on the origin by “pulling” commits

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Branching and Merging Changes on Git Repository

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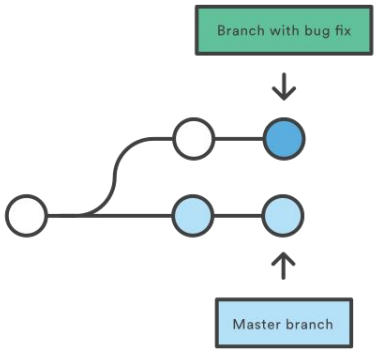
Understanding: Branches

- Allows file modification until ready (bug tested, standard verified, etc.)
- Represent independent lines of development
  - Features added without having everyone work on same file constantly
  - Can be “merged” when production ready
  - Git repositories automatically start with master (main) branch



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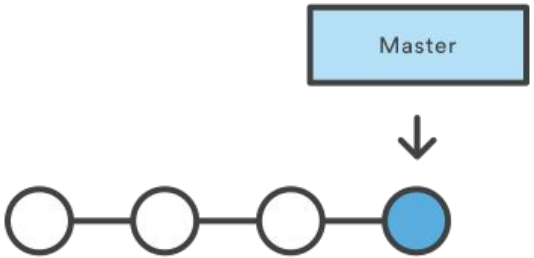
Understanding: Branches

- Simply commit pointers
  - Git creates new pointer rather than creating new set of files/folders
- Prior to creating branches, Git repository can be mapped as following:



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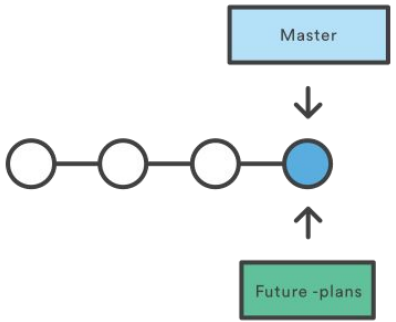
Adding Branch to Origin Repository

- To create a branch, head to top level of local repository
  - Execute `git branch future-parks` to create new branch named “future-parks”
    - Creates branch but does not switch you to that branch
- Repository at present state can be mapped as following:



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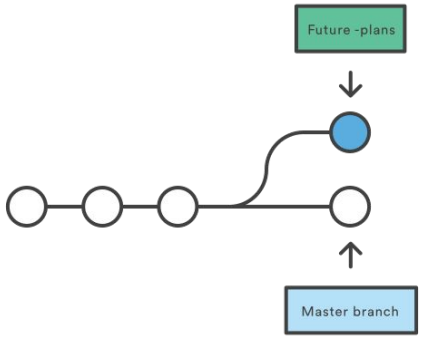
Adding Branch to Origin Repository (continued)

- Pointer updated to current branch
- To work in new branch, “check out” to desired branch
  - Execute `git checkout future-parks`
- After checking out, repository can be mapped as following:



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Creating Branch and Checking Out Shortcut

Use the following command to create a branch and check it out:

```
git checkout -b future-parks # create and checkout the branch
```

Which is same as the following command in a sequence.

```
git branch future-parks # create the branch
git checkout future-parks # checkout the branch
```

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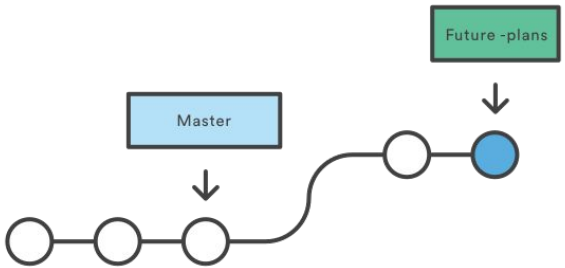
Using Newly Created Branch

- Now head to `locations.txt` and add another location: `Yellowstone`
  - Save file and close
  - Head to shell and execute `git status`
    - Notice that status indicates changed branch
- Stage (`git add`) and commit file (`git commit`)

Using Newly Created Branch (continued)

- With newest commit, Git repository can be mapped as following:
  - The `future-parks` branch is now ahead of the `master` branch



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Merging via Fast-Forward Merging

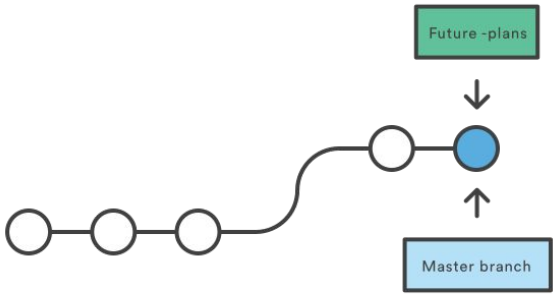
- After `future-parks` branch is developed enough, merge into `master` branch
  - *Enough* is vague term dependent on context
- *Fast-forward* merge because only one branch
  - Linear path exists from current branch tip to target branch
  - Combines current branch tip histories to target branch tip instead of “merging”
- Common for short-lived branches (not longer-running feature integrations)

Merging via Fast-Forward Merging (continued)

- Navigate to top-level of repository
- Verify changes are committed and current branch via `git status`
- Next switch to `master` branch via `git checkout`
  - Execute `git checkout master`
- Merge changes from `future-parks` to `master` branch
  - Execute `git merge future-parks`
- Delete `future-parks` afterward (not being planned to be used in the future)
  - Execute `git branch -d future-parks`
- See results of merge using `git status`

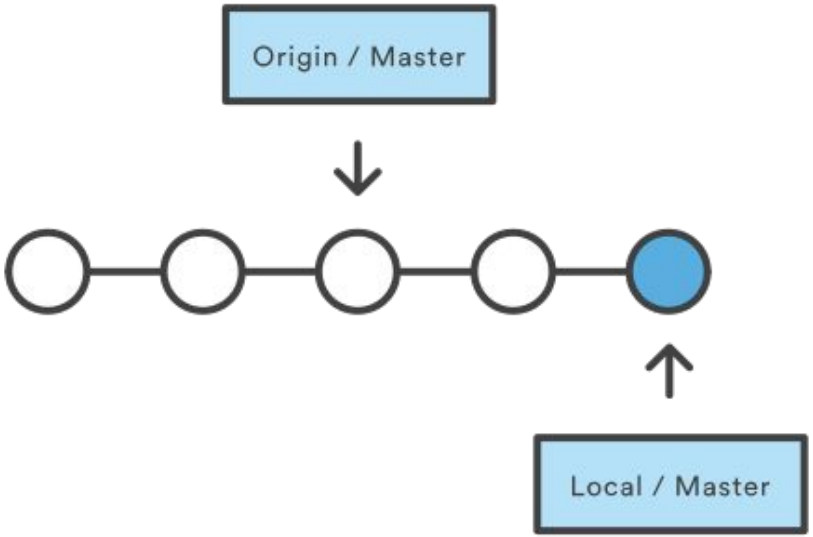
Merging via Fast-Forward Merging (continued)

- Effect represented as following:

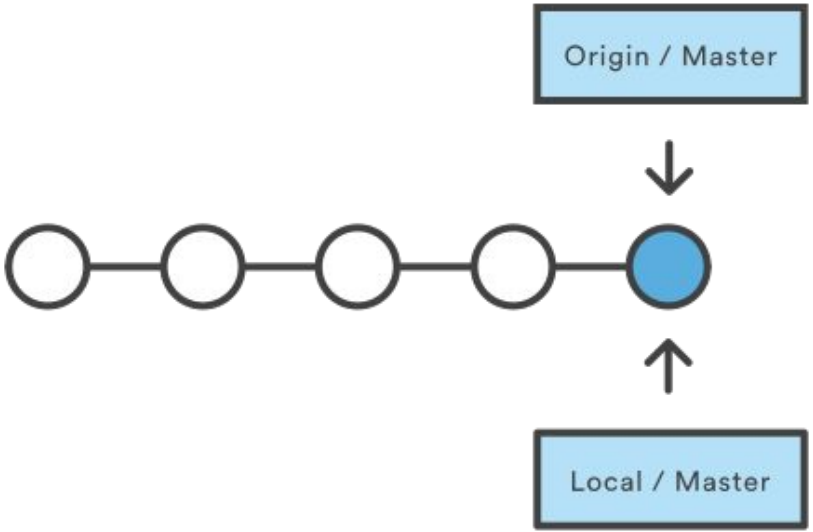


Sharing Local Changes to Origin

BEFORE PUSHING



AFTER PUSHING



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Sharing Local Changes to Origin (continued)

- Push changes to remote repository
  - Execute `git push origin master`
  - Sometimes, `git push` also works (be careful, `git` will make assumptions for you!)

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Other Notes (optional)

- University of Manitoba supplies students with GitHub Pro accounts
  - Head to https://education.github.com/students to claim Pro account
    - Will require student email address
    - Will take time to verify (Pro version not needed immediately for this workshop)
  - Head to https://education.github.com/pack to see additional University of Manitoba perks
- Alternative to command-line: GitHub Desktop (for casual users)
  - Use GitHub's GUI application to perform same operations as command line Git
  - Head to → https://desktop.github.com/ to download (free)

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Closing Remarks

Consider joining UMIEEE!

edu.ieee.org/ca-umieee/about-ieee/join-ieee-2/

Consider joining .devClub!

umdevclub.slack.com/signup

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Questions?

Thanks for attending our workshop!

We will now take any additional remaining questions! (Please place in the chat.)

If you have more questions, join UMIEEE.